PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

New or Improved Holding Means for Doors, Gates, Windows, Shutters, Furniture and like Drawers, and other Hinged, Pivoted, Sliding or otherwise Movable Articles or Parts

I, SYDNEY RICHARDSON, a British Subject, of 47, Station Road, Hinckley, Leicestershire, do hereby declare the nature of this invention to be as follows:—

This invention appertains to holding means and the principal object in view is to provide new or improved means for holding a door in the closed position so as to prevent rattling or accidental or undesired opening thereof.

For the sake of convenience and succinctness in the following description, the new or improved means constituting the invention will be mainly regarded and described as applied to a door of the hinged type, although the description will in many respects be applicable also to a door of the sliding type, but it is to be understood that the invention is capable of and intended for a much wider application, for example, it may be applied to gates, windows, shutters and other hinged, pivoted, sliding or otherwise movable articles or parts. The new or improved means may be applied to the doors of houses, rooms and the like, to cupboard and wardrobe doors, to the doors of railway vehicles and omnibuses and other road vehicles, to casements, to the drawers of furniture and fittings and so on. In some cases the new or improved holding means constituting the invention may be applied so as to be additional to the usual fastening or locking means such as the latch, lock, catch or other conventional fastener, while in other cases the new or improved means may be applied to serve as a substitute for the usual holding means of conventional kind, this depending upon circumstances and requirements.

While as already mentioned, the primary object is to provide new or improved means for holding a door in the closed position, the invention may be applied for use to hold a door in a semi-closed or in the open position as will be hereinafter described.

Since as above explained, the invention admits of a wider application for use than to a door, the term "door" in the following description should be construed in a generic sense as meaning also any other movable article or part such as hereinbefore referred to, and similarly the term "jamb" or "doorframe" hereinafter used should be understood as meaning also any other fixed part to which the door is relatively movable, either hingedly, pivotally, slidably or otherwise.

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The new or improved holding means constituting the invention operate magnetically for the intended purpose.

The magnetic influence for the holding purpose is preferably obtained from one or more permanent magnets suitably applied. Alternatively, however, electro-magnetic means may be adapted for the same purpose.

In my new or improved means of the permanent magnet type, there may, for example, be a permanent magnet in or on the jamb or doorframe, and a strip, bar or other member of magnetic material in or on the door so that when the door is in the closed position the magnetic attraction of the strip, bar or member towards the magnet will hold the door closed. Or for the same purpose there may be a permanent magnet in or on the door and a strip, bar or other member of magnetic material in or on the jamb or doorframe; or there may be a permanent magnet in or on the door and a permanent magnet in or on the jamb or doorframe, these magnets being so positioned on the respective parts that when the door is in the closed position the mutual attraction between the opposite poles of the adjacent magnets will hold the door closed.

It is a feature of the invention that in order to permit easy opening of the door, the magnetic holding means may be so arranged and operable that the magnetic influence tending to hold the door closed can be somewhat reduced or to a greater or lesser extent or even wholly neutralized when required. For instance, if a strong permanent magnet is used which requires considerable energy to separate magnet and contact piece when opening the door, by reducing the effect of the magnetism for holding the door the effort required to open the door will also be reduced. Thus if when the door is in the closed position the holding magnetic influence can, for instance by a mechanical action by the person desiring to open the door, be reduced or neutralized as aforesaid, the effort required to open the door will be proportionally reduced. When the holding influence is obtained by a permanent magnet, one manner of providing for the easy opening of the door may be to arrange for either or both of the magnetic members to be movable, e.g. slidable, at will so as to break or partially break magnetic contact or pull. It may for example be arranged that such movement will, for the purpose stated, displace the co-operating magnetic portions of the members from register, or interpose a non-magnetic or diamagnetic substance or material between them, or take the co-operating magnetic portions of the members out of register and bring non-magnetic or diamagnetic portions into register, or produce or widen a gap between said members. Or instead of making either magnetic member movable, there may be another movable member associated with one or both of the magnetic members and mechanically operable for the same purpose of reducing the magnetic influence for holding e.g. by interposing a non-magnetic or diamagnetic substance or material between the magnetic members or their co-operating portions. It may be arranged for the said movement of the member or members mentioned to be conveniently effected by the operation of a lever, handle, knob or some similar member on the door. This feature of the invention will be more fully described later herein.

It may be here stated that in carrying out the invention by means of permanent magnets, those of the bar type are preferably used, but the invention is not restricted to magnets of this type as permanent magnets of the horse-shoe type or of other shapes may be employed. It should be understood that the member of magnetic material, previously referred to by way of example as a strip or bar, which is to be attracted to the magnet for the holding purpose, may take any suitable form for the intended purpose and may be of a ferromagnetic or other suitable material subject to be influenced by the magnetic field. For convenience, this member will be hereinafter referred to as a contact piece. In carrying out the invention the permanent magnet and contact piece may in some instances be applied so that for the holding purpose the contact piece will have actual touching contact with the magnet, but in other instances the magnet and contact piece may be so applied that for the holding purpose there is no actual touching contact between the two in which case the contact piece will become situated close to the magnet so that the magnetic field will be effective upon the contact piece for the intended purpose notwithstanding the gap between the two. Unless the context otherwise requires, " contact " should be taken to mean the situation wherein the contact piece is either touching the magnet or is in effective close proximity to it without touching as above described, and the expression " contact piece " should be taken to mean the ferromagnetic or like member attracted by the magnet irrespective of whether said member is arranged to make actual touching contact with the magnet or not for the holding purpose. Similarly, if instead of a magnet and contact piece two magnets are used, then said magnets may or may not come into actual touching contact when in the holding situation, and the term " contact " when applied to two magnets is likewise to be taken to mean a situation wherein they may be actually touching or in close proximity without touching. The advantage of using two magnets is that double the strength of magnetic pull is thereby obtained over the use of a single magnet and an associated contact piece.

Any number of magnets and associated contact pieces or magnets may be used on the same door according to the strength of hold required.

For the magnet, or for each magnet if more than one, there may be a single associated contact piece and if both poles of the magnet are exposed for use, the contact piece may be arranged to be attracted by both poles; or again if both poles of the magnet are exposed for use, there may be provided separate contact pieces for co-operation with each pole.

The contact piece associated with a magnet may be arranged to act as a temporary keeper when touching contact with both poles occurs when the door is closed. The magnet may be provided with a permanent keeper: for example, a bar magnet may be arranged with both poles exposed on one side to attract the associated contact piece or magnet, and on the other side have a keeper strip extending from pole to pole.

The magnet and the associated contact piece or associated magnet may be so applied to the respective parts that upon closing movement of the door the approach of the magnet to the associated contact piece or associated magnet, or *vice versa*, will take place facially or will take place laterally or edgewise like a sliding movement of the one over the other. When the approach is facial it may terminate with an actual touching, when the approach is in the nature of a movement of one part over the other it may be preferable to avoid an actual touching contact.

When there is to be actual touching contact between the magnet and associated contact piece or associated magnet, in order to prevent damage to the magnet or magnets if the door is shut violently or allowed to bang, suitable means may be provided to act as a shock absorber. For example, a pad of rubber, felt or other suitable material may be provided at the back of the magnet or/and behind the associated contact piece or associated magnet, or between the magnet and associated contact piece or magnet, or between the door and jamb.

If it is required that the contact shall occur without actual touching of the magnetic members, this may be provided for by sinking the magnet or/and the associated contact piece or associated magnet slightly below the surface of the doorframe or jamb as the case may be; or thin distance pieces may be provided to prevent actual touching of the members.

When as previously mentioned, a permanent keeper strip is disposed at the back of a bar magnet, the magnet or/and keeper strip may be so shaped that the keeper will be in metallic contact with the pole ends of the magnet but will be spaced away from the body portion of the magnet intermediate of the poles. For instance, the bar magnet or/and the keeper strip may have its middle part concaved, reduced in thickness, recessed or similarly formed e.g. by grinding, forging, casting or other process so that continuous contact is not made between the keeper and magnet along the length between the poles, i.e. so that there will be an air gap between the middle portions of the magnet and keeper. This may also be similarly done with the magnet and contact piece.

The magnet and its permanent keeper strip may be attached to the door or jamb by countersunk or other screws or by clips or other means. For example, the magnet and keeper may be fastened together (e.g. by screws or rivets) and be attached as a unit to the door or jamb: or the keeper may be first attached and then the magnet attached to the keeper or to the door or jamb: or the magnet and keeper (as separate articles) may be attached at the same time by the same means, for instance screws passed through both of them.

I will now describe some further examples of the manner in which my invention may be carried out by the use of one or more permanent magnets. Thus far it will have been seen that my broad idea is that the desired holding shall be effected by magnetic attraction between a member on the movable body and a member on the fixed body. These complementary members (magnet and contact piece, or magnets) may be applied so as to be effective between the edge of the door and the jamb or doorframe at the closing edges or at the edges where—in a hinged door—the hinges are usually situated, or at the top e.g. between the top edge of the door and the lintel of the doorframe, or in any position where actual separation of the door and frame occurs. The complementary members may be similarly and appropriately applied to a sliding door.

A bar magnet may be disposed in the edge of the door or jamb so as to pair up with a contact piece disposed in the edge of the jamb or door and said members may be so aligned or positioned to register that when the door is in the closed position the contact piece and magnet will be in contact whereby the magnetic pull between magnet and contact piece will hold the door in the closed position. If in this arrangement, the contact piece actually touches both poles of the bar magnet it may serve as a temporary keeper as well as the magnetic member associated with the magnet.

I will now further describe the provisions which may be made according to my invention for reducing or neutralizing the magnetic influence to enable the door to be easily opened.

If the contact piece is composed of a ferromagnetic material such as iron, steel, nickel or cobalt, strong magnetic attraction will occur when said contact piece is brought into contact with either or both poles of the magnet in which case considerable force is required to separate the contact piece from the magnet. If, however, a diamagnetic material is interposed between the contact piece and pole or poles of the magnet the magnetic influence acting upon the contact piece becomes so reduced that but little force is required to separate the contact piece from the magnet even though the interposed diamagnetic material may be extremely thin e.g. .002 of an inch. The object I have in view may therefore be achieved in one way, for example, by the provision of facings or inserts of diamagnetic material disposed on or in the contact piece at a point or points where they will cover an area of the contact piece of such size that will screen the poles of the magnet when in register face-to-face therewith, whereby the magnetic pull on the contact piece will be so enfeebled as to permit easy separation of the magnet and contact piece. When either the magnet or the contact piece is moved lengthwise so that the magnet poles become clear or partly clear of the interposing diamagnetic facings or inserts, strong magnetic attraction between the magnet and contact piece occurs and greater energy is required to separate the magnet and contact piece. If only one pole of the magnet is screened by the diamagnetic material from contact with the contact piece, that pole loses its pull on the contact piece or has its pull reduced, while the other pole, being nonscreened maintains strong magnetic contact with the contact piece. A weakening of the magnetic pull might be obtained another way by arranging that one pole of the magnet could be brought to a position beyond the end of the contact piece while the other pole remains in contact with the contact piece. Again the same object may be achieved by providing one diamagnetic facing on or insert in the contact piece and arranging that the members can be brought to a position where one pole of the magnet is beyond the end of the contact piece while the other pole is in register with and screened from the contact piece by the facing or insert so that there would only be the enfeebled attraction through the diamagnetic material to overcome in order to separate the contact piece from the magnet. The magnet and contact piece may be brought to the relative positions above described by an appropriate movement of either or both of them and while I have mentioned a diamagnetic material as being used for the one or more facings or inserts I might use instead a suitable non-magnetic material or one which is only feebly subject to the magnetic flux. Another way to attain the desired object may be to have a contact piece, as for instance a strip or bar, of non-magnetic material provided with facings or inserts of magnetic material spaced apart to normally register with the magnet poles when the magnetic hold is required to be effective, the magnet or contact piece, or both, being movable so that when desired the magnet poles and facings or inserts can be brought to a position out of register and so reduce or neutralize the magnetic pull upon the contact piece.

Some further examples of means whereby the magnetic influence may be reduced or neutralized according to my invention may be mentioned. Non-magnetic facings or inserts may be provided on both the magnet and contact piece and be so disposed that by movement of the magnet or contact piece, or both, the non-magnetic facings or inserts of the two members can be brought into facial register to reduce the magnetic pull between the two. The said facings or inserts of the magnet would be located near the poles. In another arrangement two separate magnetic contact pieces may be fixed in the edge of the jamb or door these being so positioned as to register and contact with the poles of the magnet in the door or jamb, the magnet being slidably movable so that its poles can be moved away from the contact pieces to a position where they will have less magnetic influence upon the contact pieces; for instance, the magnet may be moved up or down to bring its poles opposite a non-magnetic material such as the woodwork of the jamb or door; one pole may for instance come opposite the woodwork between the contact pieces while the other pole comes opposite the woodwork beyond the adjacent contact piece.

In most, if not all of the examples previously described where provision is made for reducing the effect of the magnetic influence, it is thought that a permanent magnet of the bar type may be preferable and that the contact piece associated with such magnet may conveniently take the form of a strip or plate or the like but the invention is not to be taken as being limited in this respect as a magnet or/and contact piece of some other form may be used.

One suitable form of contact piece for the before mentioned purpose may consist of a continuous strip or plate of non-magnetic material or of paramagnetic material such as aluminium, platinum or crown glass (which materials are only feebly magnetically attracted) having inserts of ferromagnetic material such as iron, steel or suitable alloys, which inserts constitute the portions of the strip or plate for the magnetic contact with the magnet. In another form, the contact piece may consist of a strip or plate of ferromagnetic material throughout its length and have inserts of diamagnetic material disposed so that the poles of the magnet may, by slidably moving the magnet or contact piece, be caused to face said inserts when easy break of the magnetic contact is desired. In another form the contact piece may consist of a strip or plate of sectional character comprising alternating diamagnetic and ferromagnetic sections of equal thickness and welded or otherwise joined to give strength through the whole length of the strip or plate; in such contact piece the magnet poles would register with the ferromagnetic sections for the holding purpose and with the diamagnetic sections for easy release. If desired, when the ferromagnetic strip or plate has diamagnetic inserts these may be of thin material—or instead of being inserts they might be thin facings—so that when the magnet poles are in register with them the magnetic influence will be maintained in some measure though sufficiently weak to enable easy separation of the contact piece from the magnet to be effected.

While a strip or plate may perhaps be the most suitable form for use as the contact piece, studs, nails or screws may be adapted to serve instead for co-operation with the magnet.

The magnetic member (magnet or contact piece) which is to be movable for the purpose hereinbefore described may be slidable in an open casing or have guide members which keep it level or sunk in a cavity, or it may be otherwise arranged in slidable manner appropriate for the purpose. Although, especially when a bar magnet is used, a slidable movement of the movable member is preferable, the said member may be arranged for operation by a rotary, oscillatory or other appropriate motion for the intended purpose. The movement, whether slidable or otherwise, may be applied to the member either direct from the manually operable member (handle, lever, knob or the like) or through the medium of multiplied leverage or gearing or other appropriate means according to the extent of movement required and to afford desired ease in operation. The movement of the movable member may be assisted or/and controlled by spring means, and it is preferable that the said movable member shall normally be in that position where it can co-operate with the associated magnetic member for the holding purpose so that upon the door being moved to closed position the magnetic means will at once become operative for the intended purpose. In such preferred arrangement the movable magnetic member is moved from the described normal position by the manually operable member for the purpose of easing the break of contact when the door is to be opened. It is also preferred that the movable magnetic member shall, upon the manually operable member being released, return automatically to the normal position aforesaid; such automatic return may be effected by spring, weight or other suitable means; magnetic means might even be applied for this purpose. Alternatively, the movable magnetic member may be arranged so that it requires to be moved both to and from the normal position by the manually operable member.

The bar magnet may be of rectangular or other cross section as may be most appropriate for the intended application of the magnet. In most cases it is thought that a bar magnet of rectangular or square cross section will be chosen as this shape enables the magnet to present a flat face to the associated contact piece and its flat back and sides facilitate its being fitted into position for use.

By way of further illustration I will now briefly describe some practical constructional forms and applications of the new or improved holding means.

In another constructional form, movable type, a bar magnet of rectangular cross section is secured, by countersunk screws, with a permanent keeper strip at the back in a recess in the jamb with its front face and the front face of both poles exposed, the said faces being flush with the face of the jamb. A contact piece consisting of a flat strip or bar having end portions of magnetic material facially exposed and spaced to register and contact with the exposed front faces of the respective magnet poles when the door is closed, is slidable endwise up and down in a recess in the door and is operable by a lever handle on the door. If the contact strip or bar is moved either up or down from the normal position, its magnetic end portions are displaced from register with the magnet poles to break or reduce the magnetic contact. The lever portion of the handle is slotted and engages with a pin or stud projecting on the back of the centre portion of the contact strip or bar.

In another constructional form, movable type, a contact piece consisting of a flat strip or bar of iron or steel is secured by countersunk screws in a recess in the jamb with its face exposed and flush with the face of the jamb. At a suitable position between its ends the said strip has inserted and secured in its front face a plate of copper, brass or other diamagnetic substance. A bar magnet of rectangular cross section having a keeper strip attached to the back thereof is arranged for endwise slidable movement in a recess in the door and has its front face and the front face of both poles exposed. When the magnet occupies the normal position in the door, its exposed pole faces can, when the door is closed, register and contact with the portions of the iron or steel strip on either side of the inserted plate and thus hold the door closed by the magnetic attraction. There is a lever or pivoted handle on the door which engages a roller on a stud projecting on the back of the magnet and when the magnet is moved endwise from normal position such movement brings the magnet to a position where one of its poles projects beyond the adjacent end of the iron or steel strip while the other pole comes opposite the inserted plate in said strip thus breaking or reducing the magnetic influence.

In a further constructional form, movable type, a bar magnet of rectangular cross section is fixed in a recess in the jamb with its front face and the front faces of its poles exposed. This magnet has non-metallic inserts in its front face between the poles, there being one such insert near each pole. Slidable endwise in an open-fronted casing inserted in the door, is a contact piece consisting of a flat strip or bar of magnetic material one face of which is exposed to the front face of the magnet. This strip or bar has in its exposed face two inserts of non-magnetic material spaced apart the same distance as that between the exposed pole faces of the magnet. When the door is closed and the strip or bar is in the normal position for attraction by the magnet, both its non-metallic inserts are out of register with the exposed pole faces one of said inserts being in register with the magnet insert near the adjacent pole and the other insert of the strip or bar being positioned beyond the other pole of the magnet. The strip or bar can be moved endwise by operation of a handle lever on the door the lever portion of which engages with a recess in the back of the strip or bar and when the contact piece is moved from the normal position its two non-magnetic inserts come into a position opposite and in register with the respective exposed pole faces to reduce the magnetic effect of the magnet upon it.

Referring again generally to the magnetic holding means, it may be mentioned that the faces of the magnet poles or/and the faces of the associated contact piece or magnet between which the magnetic contact is to be made as hereinbefore described, may be flat or they may be rounded to form an air gap. A similar provision may be made where a permanent keeper is associated with the magnet. The contact piece may be made of springy metal to break the blow when rapid contact is made. When the magnetic holding means are applied to the hinged side of a door the magnetic contact will be made at an angle when the door closes. Instead of applying the magnetic means by insertion into the door and jamb or lintel said means may be fitted to brackets or blocks attached to the door, jamb or lintel. The magnetic means may be coated with a suitable substance to prevent rusting or corrosion but which will not retard the magnetic flux. If the holding means are to be applied for holding a door in an open or semi-closed position this may be done by attaching the fixed magnetic member to the floor or to a block, bracket or the like fastened on the floor at the desired position in which the door is to be held so that the associated magnetic member on or in the door can co-operate with said fixed member for the holding purpose. When instead of a magnet and an associated contact piece, a magnet and an associated magnet are used as the magnetic members, similar appropriate provisions to those hereinbefore described may be made for enabling the magnetic influence to be reduced or neutralized to facilitate separation of said members from contact to provide ease of opening of the door. When non-magnetic facings or inserts are provided these may be attached to the magnetic member (magnet or contact piece) in any suitable manner e.g. by rivets, screws, brazing, welding; the inserts may be dovetailed into the member; or the facings or inserts may be secured in position on the member by the screws by which said member is fixed in or on the door or jamb. When security of the door in the closed position is a requisite, the magnetic holding means may be applied for use as an adjunct to the conventional lock, bolt or other fastening by which security is obtained. The associated magnetic members constituting the holding means may be applied one to the edge of the door and the other to the opposing face or side of the jamb over which latter the door edge moves when closure of the door occurs, or they may be applied one to the face of the door near its edge and the other to the face or shoulder of the jamb with which latter the door makes contact on closure in which case the approach of the magnetic members will be facial. It is preferable where possible to apply the associated magnetic members so that they will have a facial approach and contact rather than a sliding or lateral one although in some cases the sliding or lateral approach may admit of easier application and even be advantageous. When non-magnetic or diamagnetic facings or inserts are provided it will be understood that these will be of such a shape, area and thickness in relation to the magnet poles as to be effective for their intended purpose. The " contact " between such facings or inserts and the magnet poles may or may not be a touching one. The magnetic members may be of any reasonable length or size according to requirements.

While a contact plate or piece may be disposed flatly to the magnet or the magnet flatly to face the contact plate or piece, effective magnetic contact may be provided for by shaping either the contact plate or piece or the magnet bar concavely, so that only the extreme tips of both magnet and contact plate or piece form the nearest points of contact, though the tips or near end portions need not form an apex actually, but may well be extended towards the centre position of the magnet bar for a portion of the length, so that if both magnet and contact plate or piece are substantially flat at both ends towards each other, variations may be made in either the magnet or contact plate or piece or both by corrugating, grooving, fluting or other serrations which would increase the superficial area of the metals in either magnet or contact plates or pieces. While the foregoing describes the contact plate or piece as being substantially flatwise, a contact plate or piece may be disposed on the edge of a door or jamb so as to make edgewise contact at the centre of the magnet lengthwise, so that sectionally the contact plate or piece forms the stem of a **T**, the magnet section forming the top or cross piece of the **T**. In a like manner it may be arranged for contact to be made by members in an **L** relationship; contacts may be made along the edges of both magnet and plate so that sectionally the **L**. or the **T**, is formed by either magnet or plate according to the disposition of either, though contact may well be haphazardly made along the length of the magnet and contact plate or piece or even crosswise. A contact strip may be longer than the magnet, which may be of convenient length, so that the length of the contact strip may overlie or extend beyond the magnet ends, and may have an extra side extension at or near the end of the strip to form a butt by cramping or bending at an angle, so that while the body of the plate is disposed edgewise towards the magnet, the cramped extension is disposed flatly to the face side of the magnet and comes into the position above and below the magnet ends, making contact with the jamb of the door when the strip or plate is disposed on the end edge of the door and the magnet in the jamb, so that the end extensions on the strip or plate provide a buffer to prevent actual metallic contact between magnet and plate or strip when the door is in the shut position.

While a unit of magnet and contact plate or piece, or two or more magnets, may be regarded as sufficient to constitute a device. the shape or shapes of the magnets sectionally or facially may well form the fundamental basis of the device, as shapes other than flat, or substantially flat, do provide stronger pull across the lines of magnetic paths that when either magnets or contact pieces are actually flat or substantially flat in respect of the contacting faces, so that rounded poles, or poles formed as an apex sectionally, or partly radial, do exert stronger magnetic pull between magnet and contact pieces; such and other various shaping of contact points may be applied to either magnet or contact piece or both for the purpose of obtaining the highest possible strength of coercion at the contacting poles.

While holes in magnets, countersunk or otherwise, may tend to weaken the structure as well as the magnetic properties of the magnet, a small central hole may be provided in the magnet bar for attaching purposes, or a screw or screws may be set in the bar by brasing or otherwise integrally fixed to form the attaching means to the door jamb or frame, or any of the separate devices which may be used to sustain the magnet in an operable position.

While the magnet member may be solid in construction and may be of any shape in section such as round, oval, half round, triangular, rectangular or other shapes, and be disposed for use lengthwise in an upright position or substantially so, magnets may, when constructed lengthwise, be disposed so as to present the end or one of the poles towards the contact pieces in an endwise manner, so that if, as may be the case, two or more magnets are disposed separately in a parallel manner with a north and south pole at each end of the parallel position, both a north and south pole may make magnetic contact with the contact plate or member in an endwise position or end on position. If, as may be the case, a laminated arrangement of magnets with all north poles positioned at one end, all in parallel, is used, separating material of diamagnetic material would be necessary to prevent direct metallic contact between such north poles, and in the same way the whole of the number of the south poles at the other end of the laminated construction would need to be separated similarly, so that all north poles could be brought into contact with a contact member endwise, or indeed the whole of the south poles could be used in a similar manner, so that instead of a pair of poles north and south of a single magnet making the closing contacts, additional strength would be obtained by using the whole of the number of laminated north poles for the contact, or the whole of the laminated south poles for the same purpose. Alternatively a block of laminated magnets disposed perpendicularly and edgewise, presented towards the contact pieces, may bring into position the whole of a number of magnets, both north poles as well as south poles, into magnetic contact with the strip or plate, the strips or plates forming the contact piece or pieces, thereby considerably increasing the magnetic pull between magnets and contact piece or pieces. Such magnet construction may well be used in the same manner as a single magnet for the purposes heretofore described. Such laminated construction may be made by loosely coupling the magnets together, or by welding, or other means.

Boring or drilling of the magnets for the purpose of attachment may be rendered unnecessary by arranging for said magnets to be fitted into separate holding devices fastened to jambs or doors into which holding devices the magnets may be slid by dovetailing or slotting, or in which they may be secured by flanges which may be made bendable along the whole length of such holding devices, or by small portions of the lengths of the holding member, for the purposes of gripping the magnet when in the contacting positions. Such holding members may be of either a diamagnetic substance, or of materials which may form a temporary keeper, or act as a keeper so long as metallic contact was sustained. Such a holding device may well house springs or other shock absorbing materials.

The longitudinal space occupied by using a block of laminated magnets with non-magnetic spacers, presenting the poles of similarity to the contact pieces, may be varied by shaping magnets in the form of a **Z** or an **S** so that the extreme ends of such shapes form the poles, or in other shapes such as **N** or **U**, or other shapes other than straight or substantially straight.

A laminated magnet construction. e.g. a block comprising two or more permanent magnets such as above described, should be regarded as constituting, as a whole, a magnetic member such as herein referred to, i.e. it may constitute one of the complementary magnetic members of the magnetic holding means. Indeed, where a permanent magnet is herein referred to as serving as one of the magnetic members, such magnet may be of the single or solid type or it may, alternatively, be of the plural or laminated type.

The invention includes not only magnetic holding means applied to doors and other hinged, pivoted, sliding and otherwise movable articles or parts as herein described, but also the magnetic holding means comprising the requisite complementary members and other components (such as may collectively be regarded in a sense as constituting a complete device or outfit) for application to a door or other hinged, pivoted, sliding or otherwise movable article or part.

The hereindescribed constructional forms, details and methods of application of the new or improved holding means may be varied without departing from the ambit of the invention.

Dated this 20th day of December, 1943.

E. N. LEWIS & TAYLOR,
Chartered Patent Agents.
Berridge Street Chambers, Leicester,
Agents for the Applicant.

COMPLETE SPECIFICATION

New or Improved Holding Means for Doors, Gates, Windows, Shutters, Furniture and like Drawers, and other Hinged, Pivoted, Sliding or otherwise Movable Articles or Parts

I, Sydney Richardson, a British Subject, of 47, Station Road, Hinckley, Leicestershire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention appertains to holding means for holding a door in the closed position so as to prevent rattling or accidental or undesired opening thereof.

For the sake of convenience and succinctness in the following description, the invention will be mainly regarded and described as applied to a door of the hinged type, although the description will in many respects be applicable also to a door of the sliding type, but it is to be understood that the invention is capable of and intended for a much wider application, for example, it may be applied to gates, windows, shutters and other hinged, pivoted, sliding or otherwise movable articles or parts. The invention may be applied to the doors of houses, rooms and the like, to cupboard and wardrobe doors, to the doors of railway vehicles and omnibuses and other road vehicles, to casements, to the drawers of furniture and fittings and so on. In some cases the invention may be applied so as to be additional to the usual fastening or locking means such as the latch, lock, catch or other conventional fastener, while in other cases the invention may be applied to serve as a substitute for the usual holding means of conventional kind, this depending upon circumstances and requirements.

Since as above explained, the invention admits of a wider application for use than to a door, the term "door" in the following further description and in the appended claims should be construed in a generic sense as meaning also any other movable article or part such as hereinbefore referred to, and similarly the term "jamb" or "doorframe" hereinafter used (both in description and claims) should be understood as meaning also any other fixed part to which the door is relatively movable, either hingedly, pivotally, slidably or otherwise.

The object of the present invention is to provide improvements in door or like-holding means of a previously proposed form including a permanent magnet in or on the jamb or doorframe, and a permanent magnet, or a contact piece consisting of a strip, bar, or other member of magnetic material in or on the door, or *vice versa*, said holding means being operable to effect separation of the magnets, or the magnet and the contact piece, by the person desiring to open the door suchwise as to break or partially break the magnetic circuit and hence also the magnetic contact or pull tending to hold the door closed. Such breaking or reduction of the magnetic influence is effected in order to permit easy opening of the door even by a small child.

The improved holding means constituting the present invention are of the form just referred to but are characterised in that the or each permanent magnet is arranged with both poles exposed on one side, to attract the associated magnet or contact piece, and on the other side has a keeper which is made wholly or in part of magnetic material and extends from pole to pole, the arrangement being such that whenever the holding means are operated to break or partially break the magnetic contact or pull the keeper will become effective to shunt the circuit in the magnet and thereby provide a protective means to guard against ageing of the magnet.

Thus, whenever the door is held in the closed position by the mutual attraction of the magnets, or by the attraction of the contact piece by the magnet, as the case may be, the magnetic circuit will be closed as a consequence of which the or each magnet will naturally be kept. And upon operation of the holding means to break or partially break the magnetic influence tending to hold the door closed as aforesaid the or each magnet will still be kept by reason of the associated keeper becoming effective. In short, in the improved holding means the magnet or each of the magnets is permanently kept to the extent that it is never allowed to be in open magnetic circuit.

Although the shunt keeper associated with the or each permanent magnet may be of any suitable form, e.g. a keeper strip, it preferably consists of a casing in which the magnet is housed.

In the preferred embodiment of the invention there is a permanent magnet in or on the door and a permanent magnet in or on the jamb or doorframe, these magnets being housed in keeper casings and so positioned on the respective parts that when the door is in the closed position the mutual attraction between the opposite poles of the adjacent magnets will hold the door closed.

When the holding influence is obtained by a permanent magnet, one manner of providing for the easy opening of the door may be to arrange for either or both of the magnetic members to be movable, e.g. slidable, at will so as to break or partially break the magnetic contact or pull. Preferably it is arranged that such movement will, for the purpose stated, displace the co-operating magnetic portions of the members from register. Alternatively it may be arranged that the movement will interpose a diamagnetic substance or material between the members, or take the co-operating magnetic portions of the members out of register and bring diamagnetic portions into register, or produce or widen a gap between said members. Or instead of making either magnetic member movable, there may be another movable member associated with one or both of the magnetic members and mechanically operably for the same purpose of reducing the magnetic influence for holding. Any of the said movements of the member or members mentioned may conveniently be effected by the operation of a lever, handle, knob or some similar member on the door.

Accordingly an important feature of the invention resides in the provision for the intended purpose of relatively slidable, mechanically operable permanent magnets which are housed in keeper casings and are capable of being moved into and out of effective contact to establish and break the magnetic circuit or lines of force.

It may here be stated that although permanent magnets of the conventional bar type may be used, it is principally the intention to employ so-called "axial magnets" by which term is meant magnets fashioned from recently discovered heat treated magnetic alloys such as those known under the names "Alcomax" and "Ticonal" (registered Trade Marks) which permit of a very high flux density, with the lines of force extending in any predetermined direction, in a comparatively small bulk of metal. Two axial magnets of this character having contacting pole faces of an area somewhat less than 1½ square inches are capable of exerting a magnetic pull of more than 30 lbs.

The member of magnetic material, previously referred to as a contact piece may, if provided, take any suitable form for the intended purpose and may be of a ferromagnetic or other suitable material subject to be influenced by the magnetic field. In carrying out the invention with a permanent magnet and contact piece these may in some instances be applied so that for the holding purpose the contact piece will have actual touching contact with the magnet, but in other instances the magnet and contact piece may be so applied that for the holding purpose there is no actual touching contact between the two in which case the contact piece will become situated close to the magnet so that the magnetic field will be effective upon the contact piece for the intended purpose notwithstanding the gap between the two. Unless the context otherwise requires, " contact " should be taken to mean the situation wherein the contact piece is either touching the magnet or is in effective close proximity to it without touching as above described, and the expression " contact piece " should be taken to mean the ferromagnetic or like member attracted by the magnet irrespective of whether said member is arranged to make actual touching contact with the magnet or not for the holding purpose. Similarly, when two permanent magnets are used, then said magnets may or may not come into actual touching contact when in the holding situation, and the term " contact " when applied to two magnets is likewise to be taken to mean a situation wherein they may be actually touching or in close proximity without touching. The advantage of using two magnets is that double the strength of magnetic pull is thereby obtained over the use of a single magnet and an associated contact piece.

Any number of magnets and associated contact pieces or magnets may be used on the same door according to the strength of hold required.

For the magnet, or for each magnet if more than one, there may be a single associated contact piece arranged to be attracted by both poles; or there may be provided separate contact pieces for co-operation with each pole.

A keeper casing made wholly or in part of magnetic material is particularly advantageous for housing an axial magnet wherein a very high flux density is concentrated above the longitudinal axis thereof; in practice, portions of the casing may actually touch the poles of the magnet without greatly reducing or otherwise adversely affecting the lines of force, when the axial circuit is closed in contact.

When a contact piece is associated with a magnet it may be arranged to act as a temporary keeper when touching contact with both poles occurs when the door is closed.

The magnet and the associated contact piece or associated magnet may be so applied to the respective parts that upon closing movement of the door the approach of the magnet to the associated contact piece or associated magnet, or *vice versa*, will take place facially or will take place laterally or edgewise like a sliding movement of the one over the other. When the approach is facial it may terminate with an actual touching, when the approach is in the nature of a movement of one part over the other it may be preferable to avoid an actual touching contact.

When there is to be actual touching contact between the magnet and associated contact piece or associated magnet, in order to prevent damage to the magnet or magnets if the door is shut violently or allowed to bang, suitable means may be provided to act as a shock absorber. For example a pad of rubber, felt or other suitable material may be provided at the back of the magnet or/and behind the associated contact piece or associated magnet, or between the magnet and associated contact piece or magnet, or between the door and jamb.

If it is required that the contact shall occur without actual touching of the magnetic members, this may be provided for by sinking the magnet or/and the associated contact piece or associated magnet slightly below the surface of the doorframe or jamb as the case may be; or thin distance pieces may be provided to prevent actual touching of the members.

The complementary members (magnet and contact piece, or magnets) may be applied so as to be effective between the edge of the door and the jamb of doorframe at the closing edges or at the edges where—in a hinged door—the hinges are usually situated, or at the top e.g. between the top edge of the door and the lintel of the doorframe, or in any position where actual separation of the door and frame occurs. The complementary members may be similarly and appropriately applied to a sliding door.

In order that the invention may be more clearly understood and readily carried into practical effect, a specific example thereof will now be described with reference to the accompanying diagrammatic drawing which comprises a sectional view of magnetic door holding means applied to a door and jamb.

In the drawing, the door jamb is indicated at 1 and the door at 2. The jamb is recessed at 3 to receive a rectangular casing 4 which is secured in the recess by screws 5 and adapted to house a fixed permanent magnet 6. The said magnet which is U shaped and of comparatively small dimensions is of the particular kind aforesaid wherein a very high flux density is concentrated about the axis *a* of the magnet. As is now known to those acquainted with the study of magnetism such a magnet is constructed of special alloys magnetised under certain conditions of heat treatment. The two pole faces—North and South—of the fixed magnet 6 are exposed for contact with the opposite pole faces of a complementary slidable permanent magnet 7 fitted in the door 2 as will be hereinafter more fully described. The pole ends of the complementary magnet may, if desired, be partially screened by suitable oxide paint applied thereto suchwise as to surround but not actually cover the exposed pole faces. The casing 4 is made either wholly or partly of magnetic, e.g. ferromagnetic material so as to enable it to perform the function of a shunt keeper to prevent the magnet 6 from ageing. For example, the said casing may be constructed in part of magnetic metal arranged in contact with the magnet and have inserts of any suitable non-magnetic material, such as non-magnetic metal or plastics. The portions 4*a* of the magnetic casing 4 are made so as to contact the magnet 6 near its pole ends, leaving the actual pole faces exposed as aforesaid, for which purpose the said portions may conveniently engage in recesses formed in the magnet. The portions 4*a* may, if desired, be welded or similarly secured to the magnet. A non-magnetic interpole insert 8 is provided between the poles of the magnet 6, for a purpose hereinafter to be explained and the latter together with its casing constitutes a unit fixedly embodied in the door jamb 1.

The complementary permanent magnet 7 is of somewhat similar shape to but of smaller dimensions than the magnet 6, and like the latter, is also housed in a casing 9 made wholly or partly of magnetic material to act as a shunt keeper. The portions 9*a* of the casing 9 are bent to make contact with the magnet 7 near its pole ends, and a non-magnetic interpole insert 10 is provided between the poles of the said magnet. The unit comprising the magnet 7 (which is also of the axial type aforesaid) and the casing 9 is made slidable endwise up and down within a fixed non-magnetic slider case or frame 11 which is let into a recessed portion of the door 2 and secured by means of screws 12. The slidable unit is prevented from rattling in the outer fixed non-magnetic case or frame 11 by a flat spring 13 which is secured at its ends by rivets 14 to the inside back of the said case or frame and arranged for frictional engagement with the opposing back face of the casing 9. The spring 13 consequently presses the casing 9 up to the front of the fixed case or frame 11.

The slidable magnet unit is operable by a spring controlled lever handle 15 on the door. The spindle 16 of this handle extends transversely through the door and is fitted with a lift lever 17 forked for engagement with a transverse pin 18 fixed in the casing 9. The construction is such that whenever the handle is permitted to assume its normal position, the lift lever 17 depresses the pin 18 thereby pulling the slidable unit down to bring the pole faces of the magnet 7 into register with the opposing pole faces of the fixed magnet 6, so that when the door is moved up to the jamb 1 the magnetic circuit is established and there is effective contact of these faces to hold the door closed (see the dot and chain position of the magnet 6 in the drawing). When, however, the handle is turned in the appropriate direction, the lever 17 turns with it and raises the pin 18 with the result that the slidable unit is lifted, thereby displacing the pole faces of the magnet 7 from register with the poles of the fixed magnet 6 to break the magnetic contact as shown in full lines in the drawing. In this way a small child can readily break the magnetic field and release the door. Whenever the slidable unit is moved up as just described the lower pole of the magnet 7 opposes the non-magnetic interpole insert 8, while the insert 10 is moved into position to screen the upper pole of the fixed magnet 6, thereby preventing a continuous magnetic circuit across the axial lines of force. As will be seen, the non-magnetic interpole inserts 8 and 10 complete the frontal or pole face sections of the magnet casings 4 and 9 respectively.

In this example, each of the two magnetic casings, can be regarded as constituting a proportional permanent keeper by which term is meant that the casing is so designed that it functions only as a partial keeper the efficiency of which bears a direct relationship to the position, the weight and the nature of the material of the magnet housed by the said casing. Indeed, the very fact of its permanency implies that such a "proportional" keeper cannot cover the pole faces and therefore can only serve to reduce and not completely prevent the ageing of the magnet due to eddy and hysteresis losses at such times as the magnetic circuit is broken.

If, however, the magnet casings are not made to function as permanent keepers, then a permanent keeper strip, e.g. of clock spring or other suitable magnetic material, may be disposed across the magnetic field between the poles of the or each magnet, without of course closing the axial circuit.

In the event of a magnetic casing being fitted to a metal door or frame of a magnetically attractable nature, it may in some instances be found advantageous to insulate appropriate parts of the holding means with non-magnetic pads or washers.

In a modification, the or each permanent magnet may be completely encased in a solid block of metal. But if such encasing metal is magnetic, then non-magnetic interpole inserts such as those already described must, of course, be provided for the purpose specified.

If the contact piece is composed of a ferromagnetic material such as iron, steel, nickel or cobalt, strong magnetic attraction will occur when said contact piece is brought into contact with either or both poles of the magnet in which case considerable force would normally be required to separate the contact piece from the magnet. If, however, a diamagnetic material or any other suitable material is interposed between the contact piece and pole or poles of the magnet the equivalent of an air gap is produced as the result of which the magnetic influence acting upon the contact piece becomes so reduced that but little force is required to separate the contact piece from the magnet even though the interposed material may be extremely thin e.g. .002 of an inch. The object I have in view may therefore be achieved, in another example, by the provision of facings or inserts of diamagnetic material disposed on or in the contact piece at a point or points where they will cover an area of the contact piece of such size that will screen the poles of the magnet when in register face-to-face therewith, whereby the magnetic pull on the contact piece will be so enfeebled as to permit easy separation of the magnet and contact piece. When either the magnet or the contact piece is moved lengthwise so that the magnet poles become clear or partly clear of the interposing diamagnetic facings or inserts, strong magnetic attraction between the magnet and contact piece occurs and greater energy is required to separate the magnet and contact piece. If only one pole of the magnet is screened by the diamagnetic material from contact with the contact piece, that pole loses its pull on the contact piece or has its pull reduced, while the other pole, being non-screened maintains strong magnetic contact with the contact piece. A weakening of the magnetic pull might be obtained another way by arranging that one pole of the magnet could be brought to a position beyond the end of the contact piece while the other pole remains in contact with the contact piece. Again the same object may be achieved by providing one diamagnetic facing on or insert in the contact piece and arranging that the members can be brought to a position where one pole of the magnet is beyond the end of the contact piece while the other pole is in register with and screened from the contact piece by the facing or insert so that there would only be the enfeebled attraction through the diamagnetic material to overcome in order to separate the contact piece from the magnet. The magnet and contact piece may be brought to the relative positions above described by an appropriate movement of either or both of them and while I have mentioned a diamagnetic material as being used for the one or more facings or inserts I might use instead a suitable non-magnetic material or one which is only feebly subject to the magnetic flux. Another way to attain the desired object may be to have a contact piece, as for instance a strip or bar, of non-magnetic material provided with facings or inserts of magnetic material spaced apart to normally register with the magnet poles when the magnetic hold is required to be effective, the magnet or contact piece, or both, being movable so that when desired the magnet poles and facings or inserts can be brought to a position out of register and so reduce or neutralize the magnetic pull upon the contact piece.

The invention includes not only magnetic holding means applied to doors and other hinged, pivoted, sliding and otherwise movable articles or parts as herein described, but also the magnetic holding means comprising the requisite complementary members and other components (such as may collectively be regarded in a sense as constituting a complete device or outfit) for application to a door or other hinged, pivoted, sliding or otherwise movable article or part. Whereas in the specific example hereinbefore described the pole faces of the magnets 6 and 7 are flat and the movable magnetic unit is slidably mounted a movable unit with appropriately rounded pole faces may be provided and arranged within the door or frame for rotation about a longitudinal axis or centre in relation to the complementary magnet in order to break or partially break the magnetic contact or pull by means of a suitable operating member appropriately fitted.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Holding means of the form herein referred to for the purposes specified, characterised in that the or each permanent magnet is arranged with both poles exposed on one side, to attract the associated magnet or contact piece, and on the other side has a keeper which is made wholly or in part of magnetic material and extends from pole to pole, the arrangement being such that whenever the holding means are operated to break or partially break the magnetic contact or pull the keeper will become effective to shunt the circuit in the magnet and thereby provide a protective means to guard against ageing of the magnet.

2. Holding means as claimed in Claim 1, wherein the keeper associated with the or each permanent magnet consists of a casing in which the magnet is housed.

3. Holding means of the form herein referred to for the purposes specified, comprising a permanent magnet in or on the door and a permanent magnet in or on the jamb or doorframe, these magnets being housed in casings constituting shunt keepers and being so positioned on the respective parts that when the door is in the closed position the mutual attraction between the opposite poles of the adjacent magnets will hold the door closed but that when the holding means are operated to break or partially break the magnetic contact or pull the magnetic casings will become effective to guard against ageing of the magnets.

4. Holding means as claimed in Claim 1, 2 or 3, wherein either or both of the magnetic members is or are movable, e.g. slidable, at will so as to break or partially break the magnetic contact or pull.

5. Holding means as claimed in the last preceding claim, wherein the said movement displaces the co-operating magnetic portions of the members from register.

6. Holding means as claimed in Claim 4, wherein the said movement serves either to interpose a diamagnetic or other suitable substance or material between the magnetic members or to take the co-operating magnetic portions of the members out of register and bring diamagnetic or equivalent portions into register.

7. Holding means as claimed in Claim 1, 2 or 3, wherein a movable member associated with one or both of the magnetic members is mechanically operable for the purpose of reducing the magnetic influence for holding.

8. Holding means as claimed in Claim 4, 5, 6 or 7, wherein the movement of the member or members concerned is effected by the operation of a lever, handle, knob or the like on the door, or frame.

9. Holding means of the form herein referred to for the purposes specified, comprising, in combination, a fixed permanent magnet housed in a magnetic keeper case in the jamb or doorframe, a complementary permanent magnet similarly housed in a magnetic keeper case which is slidable longitudinally or rotatable within the door, and means operable by a lever handle or equivalent on the door for effecting movement of the pole faces of the magnets into and out of register, according to requirements.

10. Holding means as claimed in the last preceding claim, wherein the slidable magnetic keeper case is arranged for movement within a fixed non-magnetic case or frame mounted in the door.

11. Holding means as claimed in Claim 9 or 10, wherein each of the permanent magnets is of the type herein referred to having a very high flux density concentrated at the axis thereof.

12. Holding means as claimed in the last preceding claim, wherein each of the said magnets is **U** shaped and provided between its poles with a non-magnetic insert for the purpose specified.

13. Holding means as claimed in Claim 9, 10, 11 or 12, wherein the spindle of the lever handle or equivalent is fitted with a lever formed for engagement with a pin fixed in the slidable magnetic keeper case, for the purpose specified.

14. Door holding means which are constructed, arranged and adapted to function substantially as herein described with reference to the accompanying drawing.

Dated this 21st day of December, 1944.
E. N. LEWIS & TAYLOR,
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573,454 COMPLETE SPECIFICATION 1 SHEET

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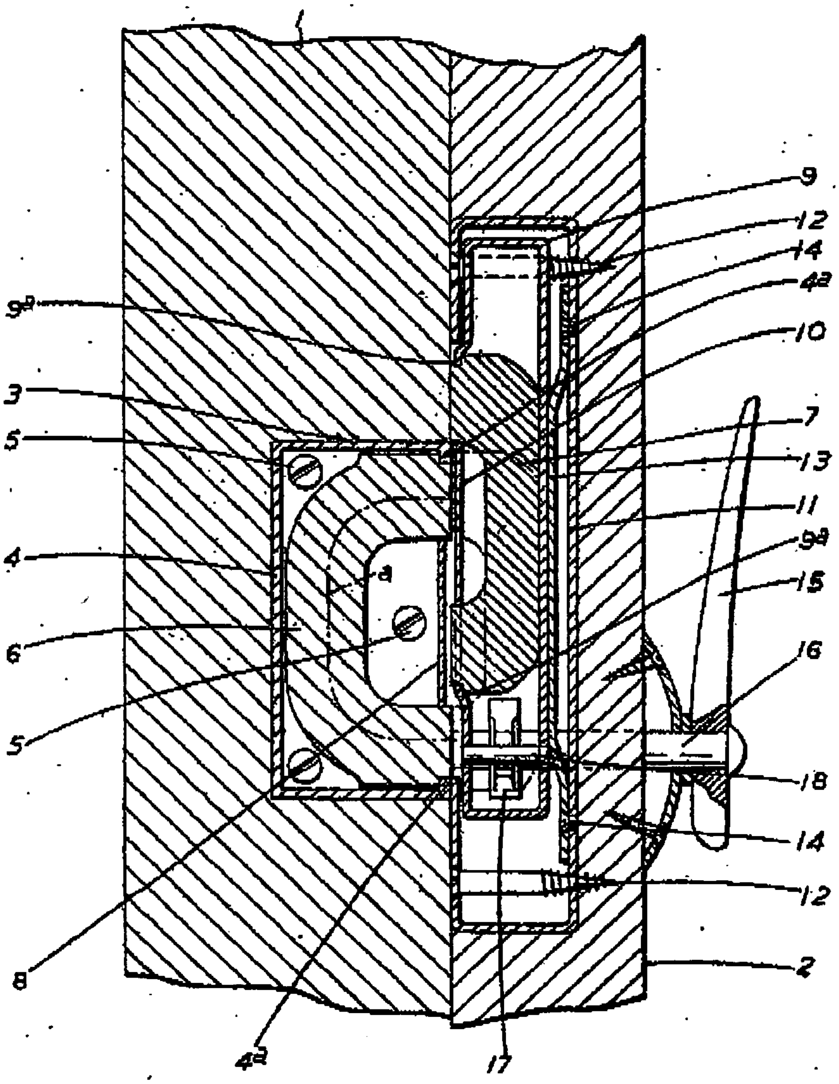

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